

(19) Japan Patent Office (JP)

(12) Publication of Unexamined Patent Application (A)

(11) Japanese Patent Laid-Open Number: Tokkai Hei 10-224875

(43) Laid-Open Date: Heisei 10-8-21 (August 21, 1998)

(51) Int.Cl. <sup>6</sup> Identification Number	FI
H0 4Q 9/00 361	H0 4Q 9/00 361
301	301E
311	311R
	311T
G0 6F 3/14 370	G0 6F 3/14 370A

Request for Examination: No requested

Number of Claims: 10 OL (10 pages in total)

To be continued to the last page

(21) Application Number: Tokugan Hei 9-23550

(22) Filing Date: Heisei 9-2-6 (February 6, 1997)

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(54) [Title of the Invention] FUNCTION CONTROL METHOD

(57) [Abstract]

[Problems]

In a case where a number of instruments are connected to a digital transmission line, or where the instruments are positioned away from one another with physical distances, the instruments cannot be collectively managed. In addition, it has been extremely difficult to select a usable instrument, to perform record and reproducing operations, to grasp operating statutes, and the like. In addition, in a case where an operating method varies depending on an individual instrument, there has been a problem in that the operation itself is extremely difficult.

[Solving Means]

Operation function units, functions, retention information, statutes and the like of AV instruments 5 to 7 connected to a digital transmission line 8 are collectively and graphically displayed on a display device 2 by using intuitive icons. This makes it possible to easily and intuitively control the instruments by use of a pointing device 3, thereby causing each of the instruments to start an operation, to suspend the operation, to restart the operation, to terminate the operation, to copy data provided by the other instruments (record reproduction and dubbing), and to program for reserving a function to be executed.

[Scope of Claims]

[Claim 1]

A function control method characterized in that:

in a system in which first to  $I$ -th ( $I$  is an integer of one or larger) operation function units are connected to one another through a digital transmission line, the operation function units

each having a function to perform specific processing on data including at least one of image information, audio information, textual information, and AV additional information associated with the AV information,

first to  $J$ -th icons corresponding to the respective operation function units are graphically displayed on a screen; and

any one of start, suspension, restart and termination of an operation of processing the data is performed by operating an icon by using a specific pointing device.

[Claim 2]

The function control method according to claim 1, characterized in that:

by dragging and dropping a  $J$ -th ( $J$  is an integer from one to  $D$ ) icon to a  $K$ -th ( $K$  is an integer from one to  $D$ ) icon by using the pointing device, the  $J$ -th icon indicating a  $J$ -th operation function unit having a function to provide specific information to the digital transmission line, and the  $K$ -th icon indicating a  $K$ -th operation function unit having a function to perform predetermined processing on the information provided to the digital transmission line,

an operation of transmitting the specific information provided by the  $J$ -th operation function unit to the  $K$ -th operation function unit through the digital transmission line is started; and

an operation in which the  $K$ -th operation function unit performs the predetermined processing on the transmitted specific information is started.

[Claim 3]

The function control method according to claim 2, characterized in that the information provided to the digital transmission line is AV information transmitted through a public

transmission network.

[Claim 4]

The function control method according to claim 1, characterized in that:

by performing a predetermined operation, by using the pointing device, on an  $L$ -th ( $L$  is an integer from one to  $D$ ) icon indicating an  $L$ -th operation function unit having a function to provide specific AV additional information to the digital transmission line, an AV additional information icon corresponding to a content of the specific AV additional information is displayed; and

by performing an AV additional information icon operation on the additional information icon by using the pointing device, a specific function control operation is performed.

[Claim 5]

The function control method according to claim 4, characterized in that:

the AV additional information includes at least program listing of programs broadcasted through the public transmission network;

the AV additional information icon is an icon which graphically displays a content of the program listing; and

the AV additional information icon operation is an operation in which the additional information icon is dragged and dropped to the  $K$ -th icon recited in claim 2.

[Claim 6]

A function control method, characterized in that, by operating an icon indicating that transmission processing of the information recited in claim 2 is in operation, any one of continuation, suspension, restart and termination of the processing

operation is carried out.

[Claim 7]

The function control method according to claim 2, characterized in that:

the  $K$ -th operation function unit has a function to record information; and

a part or all of the AV information and the AV additional information is recorded in the  $K$ -th operation unit.

[Claim 8]

The function control method according to claim 2, characterized in that:

the  $K$ -th operation function unit has a function to record information; and

the AV information is recorded in the  $K$ -th operation unit after adding a flag representing a content of data to be recorded.

[Claim 9]

The function control method according to claim 2, characterized in that:

the  $K$ -th operation function unit has a function to record information; and

a stream to be recorded in the  $K$ -th operation function unit is automatically selected from a plurality of streams, depending on a recording capability of the recording operation function unit.

[Claim 10]

The function control method according to claim 2, characterized in that:

the information provided by the  $J$ -th operation function unit to the digital transmission line includes information representing a plurality (one or more) of streams and a content of the plurality of streams; and

a stream processible by the function operation unit  $K$  connected to the digital transmission line is automatically selected among the streams depending on the information representing the content of the stream, thereby operating the processing.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a function control method for controlling operation function units each of which has an AV processing function, and which are connected to one another through a digital transmission line.

[0002]

[Prior Art]

Recently, as an instrument which has a single or multiple operation function units each having an AV processing function, there are a number of instruments such as digital video tape recorders, digital audio tape recorders, digital video disks, digital audio disks, television tuners, CRT monitors. Thus, instruments handling digitized AV data have been increased.

[0003]

Conventionally, instruments connected to one another by a digital transmission line have been disclosed in, for example, Japanese Patent Application Laid-open No. Hei 8-51447. The configuration is shown in FIG. 8 and the operations thereof will be briefly described. By referring to the drawing, an example of the above-described conventional function control method will be described below. FIG. 8 shows a configuration of instruments in the conventional function control method. In FIG. 8, reference numeral 101 is a record reproduction instrument A and reference

numeral 102 is a record reproduction instrument B. Both of the instruments have two operation function units which are an operation function unit of recording information and an operation function unit of reproducing information. In addition, reference numeral 103 is a reproduction instrument C which has an operation function unit of reproducing information. Reference numeral 104 is a digital transmission line, reference numeral 105 is a reproduction switch, reference numeral 106 is a record switch, reference numeral 107 is a reproducing status display LED, and reference numeral 108 is a recording status display LED.

[0004]

A description will be below provided for operations in the function control method of the above-mentioned configured record reproduction system. Firstly, a user checks three instruments and judges that the instrument A101 and the instrument B102 are instruments capable of recording and reproducing, and that the instrument C103 is a instrument capable of only reproducing. After that, for example, the user decides to use the instrument C103 as a reproduction instrument and to use the instrument A101 as a record instrument. Thus, the user presses the reproduction switch of the instrument C103, and then presses the record switch of the instrument A101. At this time, the LED 107 is lighted in the instrument C103 which is reproducing the information. The LED 107 indicates that the instrument C103 is outputting information. The LED 108 is lighted in the instrument A101 which is recording the information. The LED 108 indicates a status that the instrument A101 is receiving and recording information. The user who are recording and reproducing the information checks whether or not the record and reproduction have been completed or continued, by watching the lighting status

of the LEDs 107 and 108.

[0005]

[Problem to be Solved by the Invention]

In the above-described configuration, however, the collective management of instruments is impossible in a case where a number of instruments are connected to a digital transmission line, or where the instruments are positioned away from one another with physical distances. For this reason, the above-described configuration has a problem in that it is extremely difficult to select a usable instrument, to operate instruments for record and reproduction, and to grasp an operating status, and the like. In addition, there is also a problem in that the operation of instruments itself is extremely difficult in a case where an operation method varies depending on an individual instrument, and the like.

[0006]

The present invention aims at solving the above-described problems. Accordingly, an object of the present invention is to provide a function control method of collectively managing AV instruments connected to a digital transmission line. By using the method, the instruments can be operated intuitively and extremely easily.

[0007]

[Means for Solving Problem]

In order to solve the above-described problems, a function control method of the present invention is a control method in which operation function units, functions, retention information, statues and the like of AV instruments connected to a digital transmission line are collectively and graphically displayed by using intuitive icons, and in which it is possible to easily and

intuitively control of the instruments by use of a pointing device, thereby causing each of the instruments to start an operation, to suspend an operation, to restart, to terminate, to copy data provided by the other instruments (record reproduction and dubbing), and to program for reserving a function to be executed.

[0008]

[Embodiments of the Invention]

Embodiments of a function control method according to the present invention will be described below by referring to the drawings.

(First Embodiment)

FIG. 1 shows a configuration of equipment which realizes a function control method in a first embodiment of the present invention.

[0009]

In FIG. 1, reference numeral 1 is a control device, and a personal computer or the like is generally used. Reference numeral 2 is a display device of the control device 1. Reference numeral 3 is a pointing device such as a mouse. Reference numeral 4 is a memory device configured of a hard disk drive and the like. Reference numeral 5 is an AV instrument A, reference numeral 6 is an AV instrument B, and reference numeral 7 is an AV instrument C. Each of the instruments A to C has peculiar operational function units. In this example, the instrument A5 has an operation function of receiving broadcasting, an additional information reception function of receiving additional information associated with the broadcasting, and a function of displaying the information. The instrument B6 has a function of recording the information and a function of reproducing the information. The instrument C7 has only a function of displaying the information.

Reference numeral 8 is a digital transmission line connecting among the AV instrument and between the AV instrument and the control device 1. Reference numeral 9 is a public transmission network such as a telephone line and CATV, and reference numeral 10 is a wireless transmission such as satellite broadcasting, terrestrial transmission, and the PHS.

[0010]

In addition, FIG. 2 shows a display screen for control, which is displayed on the display device 2. By using the above-mentioned configuration of instruments, a description will be below given of the function control method according to the first embodiment of the present invention, with reference to FIGS. 1 and 2. As shown in FIG. 2, the AV instruments connected to the control device 1 with the digital transmission line 8 are displayed in a tree structure by using icons on the screen of the display device 2. Reference numeral 11 is a pointer, which moves on the screen in response to operations of the pointing device 3. The pointing device 3 includes a mechanism for moving a pointer and a switch for designating an icon, like, for example, a mouse. When the pointer 11 is moved to an AV icon located at the top level in the tree structure, and a predetermined operation such as a double click operation is carried out, the instruments A to C which are connected to the second level are displayed. Moreover, for example, when the instrument B is double-clicked, the operation function units included in the instrument B are displayed. This example shows that the instrument B6 has the function of recording the information and the function of reproducing the information. In addition, for example, when an information record icon is double-clicked, it can be seen that the information of recording includes an immediate record function and reservation

function. In the immediate record function, recording is immediately carried out, and in the reservation function, recording is started at a predetermined time.

[0011]

As described above, the control device 1 grasps all the functions of the connected AV instruments and can display them in an easily understandable manner. The control device 1 acquires the functions of the connected AV instruments by interacting with the respective instruments through the digital transmission line. Alternatively, in a case of the digital transmission line 8 or an instrument without such an interaction function, such information may be inputted in the control device 1 in advance and stored in the memory device 4 connected to the control device 1.

[0012]

In this manner, according to the present embodiment, the connection statuses and functions of the respective AV instruments can be visually and collectively grasped. Hereinafter, the instrument A5 is a digital television instrument having a function of receiving broadcasting, television program listing and the like through the public transmission network such as CATV or the wireless transmission such as satellite broadcasting, and a function of displaying the received one on a cathode ray tube or the like. The instrument B6 is a digital VCR having functions of recording, reserving, and reproducing the digital images. The instrument C7 is a Digital Video Disk (DVD) having a function of reproducing the digital images.

[0013]

In addition, FIG. 2 shows that the instrument C has the function of reproducing the information *d*. This means a status that there is a disk of a movie or the like whose title is *d* in the

instrument C (DVD). When this icon of *d* is dragged and dropped to an icon of the instrument A having the display function or an information display icon of the instrument A (the icon 12 in FIG. 2) by using the pointer 11, the information *d* is reproduced by the instrument A (the digital television instrument). When the reproduction is started, an icon 13 representing that the instrument A is reproducing is displayed. At this time, the control device 1 issues a command for the instrument C (DVD) to provide reproduced data to the digital transmission line 8. Meanwhile, the control device 1 also issues a command for the instrument A (the digital television instrument) to display the reproduced data of the instrument C (DVD) which have been transmitted to the digital transmission line 8. It is better to issue these commands through the digital transmission line 8, but another transmission line dedicated to the commands may be prepared.

[0014]

Additionally, when the icon 13 representing that the instrument A is reproducing is dragged and dropped to an icon 15 representing suspension, the reproduction of the information *d* is suspended. At this time, the control device 1 issues a command for the instrument A (the digital television instrument) and the instrument C (the DVD) to stop the operation. In addition, the instrument A (the digital television instrument) in FIG. 1 has a function of receiving additional information of broadcasting programs through the public transmission network 9 or the wireless transmission 10. The additional information includes program listing of the broadcasting programs. The program listing includes a broadcasting channel, broadcasting hours, a program genre, a content and the like, and these contents are displayed as a sub-tree of the additional information. FIG. 6

shows an example of the display screen of the display device 2 at this time.

[0015]

For example, the additional information *a* shows that the channel is 1ch, the broadcasting hours is from 10:00 to 11:30, the genre is a movie, and the content is XXXXXX. The number of streams to be broadcasted is not necessarily one, but in this example, three streams are broadcasted on 1ch. Specifically, a first stream is a MPEG2 stream of an interlaced image with 525 scanning lines (6 Mbps). A second stream is a MPEG2 stream of a progressive image of the same program content with 525 scanning lines (9 Mbps). A third stream is a +3 Mbps additional stream which reproduces a higher quality image of a progressive image with 720 scanning lines by adding the additional stream to the progressive image of 525 scanning lines.

[0016]

In a case where the MPEG2 stream of the interlaced image with 525 scanning lines (6 Mbps) is desired to be recorded by using the instrument B (the digital VCR), this icon is dragged and dropped to the icon of the instrument B, the information record icon which is a sub-icon of the instrument B, or an immediate icon which is a sub-icon of the instrument B, if immediate recording is demanded. Thereby, the control device 1 issues a command for the instrument A (the digital television instrument) to output a predetermined stream to the digital transmission line. The control device 1 also issues a command for the instrument B (the digital VCR) to start an operation of recording the stream provided from the instrument A to the digital transmission line. At this time, the instrument A (the digital television instrument) may provide the program listing itself to the instrument B (the digital

VCR), and the instrument B may record both of the program listing and the program.

[0017]

In addition, in a case where the sub-icon *a* of the additional information icon is operated for recording in the instrument B, since the control device 1 grasps the whole configuration and functions of the digitally connected AV instruments including the control device 1, the control device 1 may automatically select, as a default setting, a stream which can be recorded and reproduced by using the present configuration of the AV instruments, and may cause the selected stream to be recorded. For example, when the instrument B (the digital VCR) is an instrument in which the upper limit rate of recording signals is the rate of 14 Mbps, a progressive image with 9 Mbps and an additional stream with +3 Mbps are automatically recorded. Otherwise, when the whole of the instruments has only a capability of recoding up to MPEG2 stream with 6 Mbps, the MPEG2 stream with 6 Mbps is automatically selected, thereby being recorded (reserved for recording). Thus, the control device 1 may have such the intelligent record functions described above.

[0018]

In addition, a flag may be recorded in addition to the recorded stream, the flag identifying which type of the stream is the recorded stream (for example, a flag identifying an interlaced image or a progressive image, a flag identifying a main stream or an additional stream, a flag identifying a stream rate or the like). Moreover, since the control device 1 has the memory device 4 such as a hard disk, it is possible to store, in the memory device 4, management information indicating that each of the instruments provide what sort of data to which instrument (media), or the like.

For example, the program listing recited in this embodiment or the like may be recorded in a videotape, instead of recording it in a video tape, together with the information indicating which tape the data is recorded in, or the like. Needless to say, it does not matter that the program listing or the like is recorded in both of the memory device 4 and the videotape.

[0019]

At the time of reproducing, it is also possible to automatically select a stream reproducible in the system by using an identification flag recorded in the above-described manner and to reproduce the stream. For example, in a case of reproducing a video tape in which the progressive image with 9 Mbps and the progressive image with +3 Mbps are recorded, as well as in a case where the instrument connected to the digital transmission line 8 cannot process the additional stream with +3 Mbps, it is also possible to automatically reproduce the progressive image with 9 Mbps.

[0020]

According to the present embodiment, as described above, the AV instruments connected by the digital transmission line 8 are collectively managed by the control device 1, so that the AV instruments can be used even when the instruments are positioned away from one another with physical distances. In addition, by performing a collective operation by using icons, a complex operation specific to an individual instrument can be replaced with an intuitive and simple operation. In a case where the data provided by a certain instrument is recorded in another instrument, or in a case where the data reproduced by a certain instrument is displayed on another instrument, the user is not required to operate two or more of the instruments, since the control device

issues a command for two and more of the instruments. Thereby, the operation can be simplified.

[0021]

In a case where data is recorded in a record instrument such as a VCR, information representing the recorded contents and a flag representing a type of stream are recorded. This makes it possible to automatically process the data depending on processing capabilities of the whole of the connected instruments at the time of reproduction.

(Second Embodiment)

A second embodiment of the present invention will be described below by referring to the drawings.

[0022]

FIG. 3 is a view showing a control screen in a function control method of the present embodiment. The displayed tree structure is different from that of the first embodiment. In the first embodiment, in the second level of the tree structure, the connected instruments are listed, and in the third level, the operation function units are listed. On the other hand, in the second embodiment, in the second level, the operation function units are listed, and in the third level, the instruments providing the operation functions are listed. Since the first embodiment employs classification by instrument, the user is required to grasp the operational functions of the instruments in advance. On the other hand, the present embodiment employs classification by function which the user demands to use. Thereby, even when the user does not know the functions included in the instruments in advance, the user can select one of the instruments. For example, in a case where the user desires to reproduce information, but does not know which instrument has the function, the user has to seek

the function by double-clicking the instruments in the second level one after the other, in the first embodiment. In contrast, according to the present embodiment, by double-clicking the icon of the information reproduction, the icon of the instrument having the necessary function is displayed. This makes it possible to quickly reach the targeting operation even though the functions of the instruments are not known in advance.

[0023]

It depends on a purpose of an operation whether or not the operation in the first embodiment is easier or the operation in the second embodiment is easier. For this reason, it is desirable that the control device 1 be capable displaying the tree structure in any of the manners. Alternatively, depending on a purpose of use, a window corresponding to the icon may be opened by double-clicking instead of displaying the tree structure. One example of the display screens at this time is shown in FIG. 7.

(Third Embodiment)

FIG. 4 shows a configuration of instruments which realizes a function control method in a third embodiment of the present invention. Reference numeral 16 is an instrument D, reference numeral 17 is an instrument E, reference numeral 18 is an instrument F, and reference numeral 19 is a local digital transmission line. Reference numeral 20 is a room A where the instruments A to C are installed. Reference numeral 21 is a room B where the instruments E and F are installed. The instruments A, B, C, E and F are installed in a house A22. The instrument D16 is an instrument for connecting the local digital transmission line 19 to a digital transmission line 8. In addition, the house A22 is connected to a house B23 through a public transmission network 9. In the house B23, AV instruments similar to those of the house A22

are connected through a network.

[0024]

In this case, as shown in FIG. 5, on a display device 2, the tree structure under the house A22 and the tree structure under the house B23 are displayed as a management structure. With the above network connection between the houses, for example, it becomes possible that a person of the house B can use the function units of the AV instruments in the house A, while staying in the house B. This makes it possible that the person in the house B can use the functions of the AV instruments in another house, which has been conventionally impossible. The icon operations of the third embodiment are similar to those of the first and second embodiments.

[0025]

In addition, in all the first, second, and third embodiments, a control command is given to the instruments, and data is transmitted among the instruments through the digital transmission line 8 or 19 (FIG. 1). However, it also does not matter that data provided by each instrument is once transmitted to the control device 1, and that the control device 1 transmits the data to another instrument, after performing any additional processing on the data. Moreover, each of the instruments is centrally controlled by the control device 1 as in the case of the embodiments. Instead, it is also possible to realize a function or the like in which each of the instruments controls another instrument by using a remote controller included in the instrument. For example, the instrument C can directly controls the instrument B.

[0026]

It should be noted that any instrument can be used as an

instrument to be connected to the digital transmission lines 8 and 19 as long as the instrument has an interface with the digital transmission lines 8 and 19. Examples of such an instrument include a Set Top Box (STB) for receiving broadcasting, a digital VCR, a FAX/telephone, a printer, a digital video disk, a digital camera, a Compact Disc (CD), a Mini Disc (MD), a personal computer, and a Digital Audio Tape (DTA). In addition, any transmission line can be used as the digital transmission lines 8 and 19 as long as the transmission line has a target transmission capacity. For example, IEEE 1394, Ethernet (10 Mbps, 100 Mbps, 1000 Mbps or more), ATM, Universal Serial Bus (USB), RS232C or the like can be used. Moreover, an analogue telephone line, ISDN, the internet or the like can be used as the public line 9. Furthermore, a satellite, terrestrial, PHS or the like can be used as the wireless transmission 10.

[0027]

#### [Effects of the Invention]

As described above, according to the present invention, it is possible to collectively and graphically display, by using intuitive icons, operation function units, functions, retention information, statues and the like of AV instruments connected to a digital transmission line. This makes it possible to easily and intuitively control of the instruments by use of a pointing device, thereby causing each of the instruments to start an operation, to suspend an operation, to restart, to terminate, to copy data provided by the other instruments (record reproduction and dubbing), and to program for reserving a function to be executed.

#### [Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a configuration diagram of instruments realizing

a function control method according to a first embodiment of the present invention.

[FIG. 2] FIG. 2 is a diagram showing a control screen for an explanation of operations in the function control method.

[FIG. 3] FIG. 3 is a diagram showing a control screen for an explanation of operations in a second embodiment of the present invention.

[FIG. 4] FIG. 4 is a configuration diagram of instruments in a third embodiment of the present invention.

[FIG. 5] FIG. 5 is a diagram showing a control screen used for an explanation of operations in the third embodiment.

[FIG. 6] FIG. 6 is a detailed diagram of additional information in the embodiments of the present invention.

[FIG. 7] FIG. 7 is a diagram showing one example of a control screen in the embodiment.

[FIG. 8] FIG. 8 is a configuration diagram of instruments in a conventional function control method.

[Reference Numeral]

- 1 Control device
- 2 Display device
- 3 Pointing device
- 4 Record device
- 5 Instrument A
- 6 Instrument B
- 7 Instrument C
- 8 Digital transmission line
- 9 Public transmission network
- 10 Wireless transmission
- 11 Pointer
- 12, 13, 14 Icon

- 15 Operation suspension icon
- 16 Instrument D
- 17 Instrument E
- 18 Instrument F
- 19 Local digital transmission line
- 20 Room A
- 21 Room B
- 22 House A
- 23 House B

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(51) Int.Cl.<sup>6</sup> Identification Number FI  
G1 1B 15/02 346 G11B 15/02 346Z  
H0 4M 11/00 301 H04M 11/00 301

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FIG. 1

- 1 CONTROL DEVICE
- 2 DISPLAY DEVICE
- 3 POINTING DEVICE
- 4 MEMORY DEVICE
- OPERATION FUNCTION UNIT
- 5 INSTRUMENT A
  - RECEPTION OF BROADCASTING
  - RECEPTION OF ADDITIONAL INFORMATION
  - INFORMATION DISPLAY
- 6 INSTRUMENT B
  - IMMEDIATE RECORDING OPERATION
  - RESERVED RECORDING OPERATION
  - INFORMATION REPRODUCING OPERATION
- 7 INSTRUMENT C
  - INFORMATION REPRODUCING OPERATION
- 8 DIGITAL TRANSMISSION LINE
- 9 PUBLIC TRANSMISSION NETWORK
- 10 WIRELESS TRANSMISSION

FIG. 2

- 101 DISPLAY SCREEN
- 102 INSTRUMENT A, B, C
- 103 INFORMATION DISPLAY
- 104 ADDITIONAL INFORMATION
- 105 INFORMATION RECORD
- 106 INFORMATION REPRODUCTION
- 13 INSTRUMENT C-d
- 107 INSTRUMENT B IN RECORDING
- 108 INSTRUMENT B IN RESERVED

109 IMMEDIATELY  
110 RESERVATION  
111 INSTRUMENT A-a  
112 INSTRUMENT A-b  
14 INSTRUMENT C-d  
15 TERMINATION

FIG. 3

13 INFORMATION REPRODUCTION C-d  
113 ADDITIONAL INFORMATION A-a,  
114 ADDITIONAL INFORMATION A-b

FIG. 4

22, 23 HOUSE A, B  
16 INSTRUMENT D,  
17 INSTRUMENT E,  
18 INSTRUMENT F  
20, 21 ROOM A, B  
19 LOCAL DIGITAL TRANSMISSION LINE

FIG. 5

115 REGION

FIG. 6

A  
CHANNEL 1CH  
HOURS 10:00-11:30  
GENRE MOVIE  
CONTENT XXXXXX  
B

CHANNEL 25CH  
HOURS 15:00-16:00  
GENRE MUSIC  
CONTENT YYYYYY  
C  
CHANNEL 30CH  
HOURS 11:00-17:00  
GENRE SPORTS  
CONTENT ZZZZZZ  
MPEG2:6MBPS 525 INTERLACED IMAGE  
MPEG2:9MBPS 525 PROGRESSIVE IMAGE  
+3MBPS: 720 PROGRESSIVE IMAGE

FIG. 8

101, 102, 103 INSTRUMENT A, B, C  
104 DIGITAL TRANSMISSION LINE